



**Semiannual Report on the
Progress for Remedy Selection**

Ash Disposal Area 4

**TVA Colbert Fossil Plant,
Tuscumbia, Colbert County,
Alabama**

July 15, 2020

Prepared for:

Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:

Stantec Consulting Services Inc.

Semiannual Report on Remedy Selection – Ash Disposal Area 4 TVA Colbert Fossil Plant, Tuscumbia, Alabama

July 15, 2020

1.0 INTRODUCTION

In accordance with 40 CFR § 257.97(a) and ADEM Admin. Code r. 335-13-15, the Tennessee Valley Authority (TVA) prepared this second semiannual report to document progress toward remedy selection and design at Ash Disposal Area 4 (CCR Unit) at the TVA Colbert Fossil Plant (COF) in Tuscumbia, Colbert County, Alabama. Ash Disposal Area 4 is also known as Ash Pond 4.

1.1 Regulatory Background

On April 17, 2015, the United States Environmental Protection Agency (U.S. EPA) published a rule that sets forth national criteria for the management of coal combustion residuals (CCR) produced by electric utilities. The requirements can be found in Title 40, Code of Federal Regulations (CFR) Part 257, Subpart D. The rule includes requirements for monitoring groundwater and assessing corrective measures if constituents listed in Appendix IV to Part 257 of the rule are detected in groundwater samples collected from downgradient monitoring wells at statistically significant levels (SSLs) greater than established groundwater protection standards (GWPS).

The Alabama Department of Environmental Protection (ADEM) has promulgated a state CCR Rule (ADEM Land Division – Solid Waste Program, Division 13 (ADEM Admin. Code r. 335-13-15)). As the ADEM CCR Rule has not been approved by the U.S. EPA to operate in lieu of the U.S. EPA CCR Rule, TVA must comply with both the ADEM and U.S. EPA CCR Rules. This second semiannual report is also intended to comply with the requirements of the ADEM CCR Rule.

In January 2019, TVA determined if there were SSLs over established GWPS as defined in 40 CFR § 257.95(h) for one or more Appendix IV constituents in accordance with 40 CFR § 257.95(g). At Ash Disposal Area 4, assessment monitoring in 2018 detected SSLs greater than the GWPS for cobalt at monitoring well COF-102 and arsenic at COF-105. Since this time, TVA has updated the statistical analysis.

- During late-2019, TVA recalculated the statistical analysis incorporating additional groundwater monitoring data from the second assessment monitoring event in 2019.
- During mid-2020, TVA updated the statistical analysis after incorporating results from the second assessment monitoring retest event from 2019, and the first semiannual assessment monitoring event and retest event in 2020.

The same SSL was observed at monitoring well COF-105 for arsenic; however, no SSL for cobalt was observed at monitoring well COF-102. As of the date of this report, TVA has not completed a demonstration that a source other than the CCR Unit associated with wells COF-102 and COF-105 caused the SSLs, as allowed under 40 CFR § 257.95(g)(3)(ii).

In accordance with 40 CFR § 257.96(a), TVA prepared the 2019 Assessment of Corrective Measures (ACM) Report for the CCR Unit at COF, placed it in the facility operating record on July 15, 2019, and uploaded it to the TVA CCR Rule Compliance Data and Information website on August 14, 2019. The ACM Report provided an assessment of the effectiveness of potential corrective measures in achieving the criteria provided in 40 CFR § 257.96(c). Three primary strategies were evaluated to address groundwater exhibiting concentrations of arsenic and cobalt above the GWPS:

- Monitored Natural Attenuation (MNA);
- Hydraulic Containment and Treatment; and,

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- Enhanced In-Situ Treatment (EIST).

Following preparation of the ACM Report, TVA began the remedy selection process. Semiannual reports are required pursuant to 40 CFR § 257.97(a) to document progress toward remedy selection and design. The CCR Rule contemplates that more investigation and consideration may be needed to evaluate and design the remedy before making the final selection. TVA placed the first Semiannual Report on the Progress of Remedy Selection into the facility operating record on January 15, 2020 pursuant to 40 CFR § 257.97(a) and § 257.105(h)(12). TVA provided notification of the availability of the semiannual report describing the progress in selecting and designing the remedy and placed it on the TVA CCR Rule Compliance Data and Information website on February 14, 2020 in accordance with 40 CFR § 257.106(h)(9) and § 257.107(h)(9). TVA will continue to review new data as it becomes available and implement changes to the groundwater monitoring and corrective action program as necessary to maintain compliance with 40 CFR § 257.90 through § 257.98.

At least 30 days prior to the final groundwater remedy selection pursuant to the CCR Rule, a public meeting will be held with interested and affected parties to discuss the results of the corrective measures assessment in accordance with 40 CFR § 257.96(e). The selected remedy must meet the requirements of 40 CFR § 257.97(b) and must consider the evaluation factors set forth in 40 CFR § 257.97(c). Once a final remedy is chosen, a final report describing the remedy and how it meets the standards set forth in 40 CFR § 257.97(b) will be prepared. The owner/operator must provide a schedule for implementing the selected remedy that considers the factors set forth in 40 CFR § 257.97(d).

1.2 Summary of State Required Investigation and Remedy Selection Process

TVA is currently conducting environmental investigations at COF under the oversight of the ADEM pursuant to the First Amended Consent Decree, entered by the Circuit Court of Colbert County, Alabama, in Case No. 20-CV-2013-900123 (ADEM Consent Decree). This investigation is broader than the area around the CCR Unit. In May 2019, TVA submitted a Comprehensive Groundwater Investigation (CGWI) Report (May 17, 2019) to ADEM that described the hydrogeologic setting and provided an evaluation of the extent of CCR constituents in groundwater, including in the vicinity of the CCR Unit. Additional investigation activities were performed at COF in late 2019 to supplement the CGWI in combination with an ACM, which was submitted to ADEM in July 2019 pursuant to the requirements of the ADEM Consent Decree. Corrective measures at COF will be completed following remedy selection in accordance with the ADEM Consent Decree and the criteria set forth in the U.S. EPA and ADEM CCR Rules.

1.3 Report Contents

This second semiannual progress report provides a summary of COF site characteristics, the groundwater assessment monitoring program, the findings of the ACM process, and the current progress of selecting and designing a remedy for statistically significant GWPS exceedances.

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2.0 SITE BACKGROUND AND CHARACTERISTICS

COF is located at 900 Colbert Steam Plant Road in Tuscumbia, Colbert County, Alabama. The facility occupies 1,354 acres between the south shore of the Tennessee River / Pickwick Reservoir and U.S. Highway 72, approximately 12 miles west of the center of Tuscumbia, Alabama. The COF property boundaries are shown on **Figure 1**. Construction of COF began in October 1951 and commercial operations began in January 1955. Coal-fired generation ceased on March 23, 2016. The retired COF powerhouse is in the northwest portion of the property adjacent to the Tennessee River/Pickwick Reservoir.

Now closed and capped, Ash Disposal Area 4 was originally constructed in 1972 and received both sluiced bottom ash and, for a limited time, fly ash from plant operations, until 2016 when the coal burning operations were terminated at COF. Ash Disposal Area 4 is subject to the EPA and ADEM CCR Rules. Closure of Ash Disposal Area 4 was completed in accordance with an ADEM-approved closure plan and the EPA CCR Rule. Elements of closure included dewatering, grading, and constructing an engineered cap system to prevent infiltration of rainwater. Surface water management infrastructure and erosion and sediment control were also provided. Construction was primarily finished by December 2017, with closure deemed complete on March 6, 2018. The engineered cap includes a low-density polyethylene flexible membrane liner, a drainage layer consisting of a geocomposite material, cover soil, and permanent vegetative cover. The final cap and cover system design complies with the relevant standards under the EPA CCR Rule. A cross-section of Ash Disposal Area 4 is provided on **Figure 2**.

The subsurface geology at COF is characterized into three hydrostratigraphic units including a sand and gravel alluvium (alluvial aquifer), residuum (residuum water-bearing unit), and the Tuscumbia-Fort Payne aquifer (Tuscumbia Limestone bedrock aquifer). The alluvial aquifer is the uppermost aquifer for Ash Disposal Area 4, and is monitored in accordance with 40 CFR § 257.91. The site geologic setting is shown on **Figure 3**.

2.1 Conceptual Site Model Summary

The two unconsolidated units, alluvium and residuum, overlie the COF bedrock aquifer at the site. Adjacent and parallel to Cane Creek and underlying most of the Ash Disposal Area 4, alluvium deposits composed primarily of sands and gravels were deposited in the incised paleochannel and valley of Cane Creek (a paleochannel is a remnant of a former river or stream channel that has been filled or buried by younger deposits). These deposits compose a surficial alluvial aquifer that directs groundwater on both sides of the creek valley toward and into the creek. Cane Creek then flows for approximately 2.85 miles before ultimately discharging to the Tennessee River.

More evident in locations away from Cane Creek, native residuum composed of silt, clay, and chert materials formed by the *in-situ* weathering of the limestone bedrock are present up to 60-70 feet in thickness. The residuum is relatively impermeable and can act as an aquitard (a layer of relatively low hydraulic conductivity that inhibits the vertical flow of groundwater) creating localized perched pockets of groundwater. When downward infiltration through residuum material into the bedrock aquifer does occur, it is primarily through secondary openings such as desiccation cracks or relict structural features from the parent rock (joints or fractures). Horizontal flow through the residuum might occur locally but is typically of minimal volumetric flow or consequence. The residuum does include a minor water-bearing unit upgradient of Ash Disposal Area 4 that is in connection with the alluvial aquifer underlying Ash Disposal Area 4.

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2.2 Potential Receptor Review

Three public water supply utilities are present within a five-mile radius of COF including the Colbert County Rural Water System, the Cherokee Water Department, and the Hawk Pride Mountain Water System. The Colbert County Rural Water System treats up to 2.5 million gallons per day (MGD) of raw Tennessee River water to serve approximately 3,600 customers. The river water intake pipe for the filtration plant is located within the COF property boundary. The Cherokee Water Department treats up to 0.5 MGD of raw Tennessee River water to serve approximately 800 customers. The intake for the Cherokee Water Department is approximately six miles downstream of COF. The Hawk Pride Mountain Water System supplies approximately 1,350 customers with groundwater supplied by two wells that are approximately five miles east-southeast of COF and completed in the Tuscumbia-Fort Payne bedrock aquifer. These three facilities are interconnected so that one system can supply treated water to another during emergencies.

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3.0 GROUNDWATER MONITORING PROGRAM

Groundwater assessment monitoring for the Ash Disposal Area 4 CCR unit is conducted in accordance with the EPA and ADEM CCR Rules. The groundwater monitoring well network in the Ash Disposal Area 4 area was expanded. Monitoring of three alluvial/residuum wells in the area of Ash Disposal Area 4 began in 2019 as part of the groundwater investigation being conducted pursuant to the ADEM Consent Decree. The wells are being analyzed for possible inclusion in the CCR Rule groundwater monitoring well network. Monitoring well locations proximal to Ash Disposal Area 4 are illustrated on **Figure 4**.

3.1 Groundwater Monitoring Well Network

In compliance with 40 CFR § 257.91, one background well (CA5) was established upgradient and four monitoring wells (COF-102, COF-104, COF-105 and COF-106) were installed downgradient of the CCR Unit. The locations of these monitoring wells (which comprise the CCR Rule groundwater monitoring well network for Ash Disposal Area 4) are presented on **Figure 5**.

3.2 Groundwater Characterization

Groundwater assessment monitoring was conducted during 2018 and 2019, and at the time of this report, the first semiannual assessment monitoring event and retest event in 2020 had been conducted. The following Appendix IV constituents were detected at SSLs above a GWPS:

- An SSL for cobalt was identified at monitoring well COF-102 in 2018 and 2019 but was not observed in 2020
- An SSL for arsenic was identified at monitoring well COF-105 in 2018, 2019, and 2020
- The GWPS for arsenic is 10 µg/L

Data from existing wells have been utilized to characterize the nature and extent of releases from the CCR Unit as required by 40 CFR 257.95(g)(1). Additional monitoring wells have been installed that will further refine this characterization.

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4.0 ASSESSMENT OF CORRECTIVE MEASURES

TVA prepared the 2019 ACM Report for the CCR Unit and placed it in the operating record on July 15, 2019. The report was posted to the TVA CCR Rule Compliance Data and Information website on August 14, 2019. The ACM Report provided an assessment of the effectiveness of potential corrective measures in achieving the criteria provided in 40 CFR § 257.96(c).

4.1 Source Control Measures

The objectives of corrective measures under 40 CFR § 257.96(a) are to “prevent further releases [from the CCR units], to remediate any releases, and to restore affected areas to original conditions.” Ultimately, in accordance with 40 CFR § 257.97(b)(3), the selected corrective measure must at a minimum “[c]ontrol the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents of appendix IV to this part into the environment.”

The Preamble (80 Fed. Reg. 21302, 21406) to the CCR Rule discusses that source control measures may include modifying operational procedures. The CCR Unit was closed in-place and capped in accordance with 40 CFR § 257.102. Closing and capping of the CCR Unit limits water infiltration through the CCR and reduces the potential for further releases. The completed closure and capping of the CCR Unit serve as source control measures as required under 40 CFR § 257.97(b)(2). Remediation technologies are being considered to address the area of groundwater exhibiting arsenic concentrations above the GWPS. Additional details for Ash Disposal Area 4 are illustrated on **Figure 2**. For the CCR Unit, the engineered cap includes a low-density polyethylene flexible membrane liner, a drainage layer consisting of a geocomposite material, cover soil, and permanent vegetative cover. Surface water management infrastructure and erosion/sediment control were also provided. The purpose of these engineered elements is to prevent infiltration of rainwater and to control surface water runoff, thus controlling the source of the historical release. Current post-closure care of the CCR Unit includes inspections and maintenance of the engineered cap. Stability of the CCR materials and potential seeps are also monitored.

The process for selecting a remedy includes continued evaluation of groundwater assessment monitoring data, as required by 40 CFR § 257.96(b). Groundwater assessment monitoring will continue until a remedy is selected. In addition, information that is being collected as part of the ADEM Consent Decree will inform decision making related to timing, scope, and necessity of potential interim actions as well as the final selection and design of a final remedy in accordance with 40 CFR § 257.97. Groundwater monitoring data collected after closure of the CCR Unit has exhibited a decreasing trend for cobalt in COF-102. This trend suggests that unit closure is supporting improved groundwater conditions for dissolved cobalt.

4.2 Potential Remedial Technologies

The CCR Unit was closed in accordance with the requirements set forth in 40 CFR § 257.102. In addition to source control measures, three primary strategies were evaluated to address groundwater exhibiting concentrations of arsenic and cobalt above the GWPS including:

- Monitored Natural Attenuation;
- Hydraulic Containment and Treatment; and
- Enhanced In-Situ Treatment (EIST).

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The ACM Report prepared pursuant to the U.S. EPA CCR Rule provides a more detailed description of these corrective measures. The effectiveness of each potential corrective measure was assessed in accordance with 40 CFR § 257.96(c) and all are currently considered feasible for remediating the groundwater at the CCR Unit.

The separate ACM prepared pursuant to the requirements of the ADEM Consent Decree divided Monitored Natural Attenuation into the following three options:

1. Monitored Natural Attenuation via Continued Groundwater Monitoring
2. Monitored Natural Attenuation and Institutional Controls
3. Monitored Natural Attenuation, Institutional Controls, Interim Responses, and Adaptive Management

All three options include Monitored Natural Attenuation, which would be implemented to document groundwater quality improvement and trends, to confirm that off-site migration of CCR constituents to surrounding properties is not occurring, and to better understand the estimated time to achieve compliance with groundwater protection standards. Institutional controls may be used to limit future property and groundwater use. Interim responses would be established through Target Levels for groundwater that are protective of surface water. In addition, Option 3 would establish certain conditions (e.g., increasing concentration trends) that will trigger further adaptive management activities. These activities may include further investigations and/or active groundwater remedies.

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5.0 SELECTION OF REMEDY: CURRENT PROGRESS

A remedy to address SSLs in groundwater will be selected in accordance with 40 CFR § 257.97¹ and the requirements of the ADEM Consent Decree. Upon selection of a remedy, the owner or operator must prepare a final report (i.e., Remedy Selection Report) describing the selected remedy and how it meets the standards specified below pursuant to 40 CFR §257.97(b)(1)-(5). Remedies must: (1) Be protective of human health and the environment; (2) Attain the groundwater protection standard as specified pursuant to §257.95(h); (3) Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in appendix IV to this part into the environment; (4) Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems; (5) Comply with standards for management of wastes as specified in §257.98(d).

5.1 Data Requirements for Design of Groundwater Corrective Action

In order to further refine the targeted area for potential future corrective action, TVA performed the following activities to support the remedy selection in the first six months of 2020 and intends to continue this work through the remainder of 2020:

Current and Future Activities to Further Evaluate Site Conditions:

- Groundwater Elevation Mapping: Groundwater elevation measurements were collected twice during this semiannual period: February 27 and May 11, 2020. Groundwater flow maps were developed and will be included in the *2020 Annual Groundwater Monitoring and Corrective Action Report* required under 40 CFR § 257.90(e).
- Groundwater Sampling and Analyses: Groundwater sampling was conducted twice during this semiannual period: February 10-26 and May 5-11, 2020. The groundwater sampling included both CCR and MNA parameter analyses (MNA parameters are being measured or analyzed to aid evaluation of a possible MNA corrective measure).
- Cane Creek Surface Water Evaluation: A surface water evaluation of Cane Creek began in August 2019. In 2020, this evaluation included additional upstream surface water sampling and surface water elevation gauging in February, April, and June 2020. Cane Creek flow is being measured continuously in 2020 at two separate gauging stations upstream of the site and at a new gauging station installed in late April 2020 located within the facility where Steam Plant Road crosses Cane Creek.

Current and Future Activities to Further Evaluate MNA:

- Statistical Analyses of Groundwater Results: Groundwater data collected up to and including February 2020 were analyzed using statistical methods to determine whether individual wells are in compliance with applicable groundwater protection standards. The statistical methods are described in the USEPA document: “Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities. Unified Guidance” (Unified Guidance – USEPA, 2009). A summary of the evaluations will be included in the *2020 Annual Groundwater Monitoring and Corrective Action Report*. TVA plans

¹ The Alabama Department of Environmental Management has adopted a state CCR rule. As the state rule has not been approved by EPA to operate in lieu of the federal CCR Rule, TVA must comply with both the state and federal CCR regulations. This report also complies with ADEM Admin. Code r. 335-13-15-.06 (6)(g).

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to complete statistical analyses on a semiannual basis thereafter to account for more recent groundwater quality data as it becomes available.

- Groundwater Concentration Trend Analyses Pre- and Post-Capping: Trend graphs are being prepared for constituents detected in wells located downgradient of Ash Disposal Area 4 to evaluate the effect of capping on groundwater quality. This data supports the potential MNA remedy and will be provided in the *2020 Annual Groundwater Monitoring and Corrective Action Report*.

Current and Future Activities to Further Evaluate Corrective Actions:

- Groundwater Modeling: TVA continued development of a three-dimensional finite difference groundwater flow and transport model of the alluvial aquifer at Ash Disposal Area 4.

5.2 Semiannual Reporting, Public Meeting, Remedy Selection and Final Report

Progress toward the selection and design of the remedy will be documented in semiannual reports in accordance with 40 CFR § 257.97(a). At least 30 days prior to selecting a remedy, a public meeting to discuss the results of the corrective measures assessment will be conducted as required by 40 CFR § 257.96(e). A final report will be produced after the remedy is selected. This final report will describe the remedy and how it meets the standards specified in 40 CFR § 257.97(b) and 257.97(c). Recordkeeping requirements specified in 40 CFR § 257.105(h), notification requirements specified in 40 CFR § 257.106(h), and internet requirements specified in 40 CFR § 257.107(h) will be complied with as required by 40 CFR § 257.96(f), in addition to the requirements for recordkeeping, notification and internet postings under the ADEM CCR Rule.

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6.0 REFERENCES

USEPA, 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance. EPA 530-R-09-007.

Attachments:

Figures

Figure 1 – COF Facility Map

Figure 2 – Close/Capped Ash Disposal Area 4 Cross-Section Schematic

Figure 3 – Site Geologic Setting

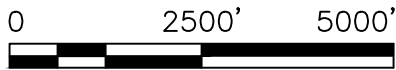
Figure 4 – Groundwater Monitoring Wells (2020) Proximal to Ash Disposal Area 4

Figure 5 – CCR Rule Groundwater Monitoring Well Network

FIGURE 1
COF FACILITY MAP

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LEGEND



TVA PROPERTY BOUNDARY
CCR UNIT

Client/Project
Tennessee Valley Authority
Colbert Fossil Plant
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Project No.
182603534 300.1

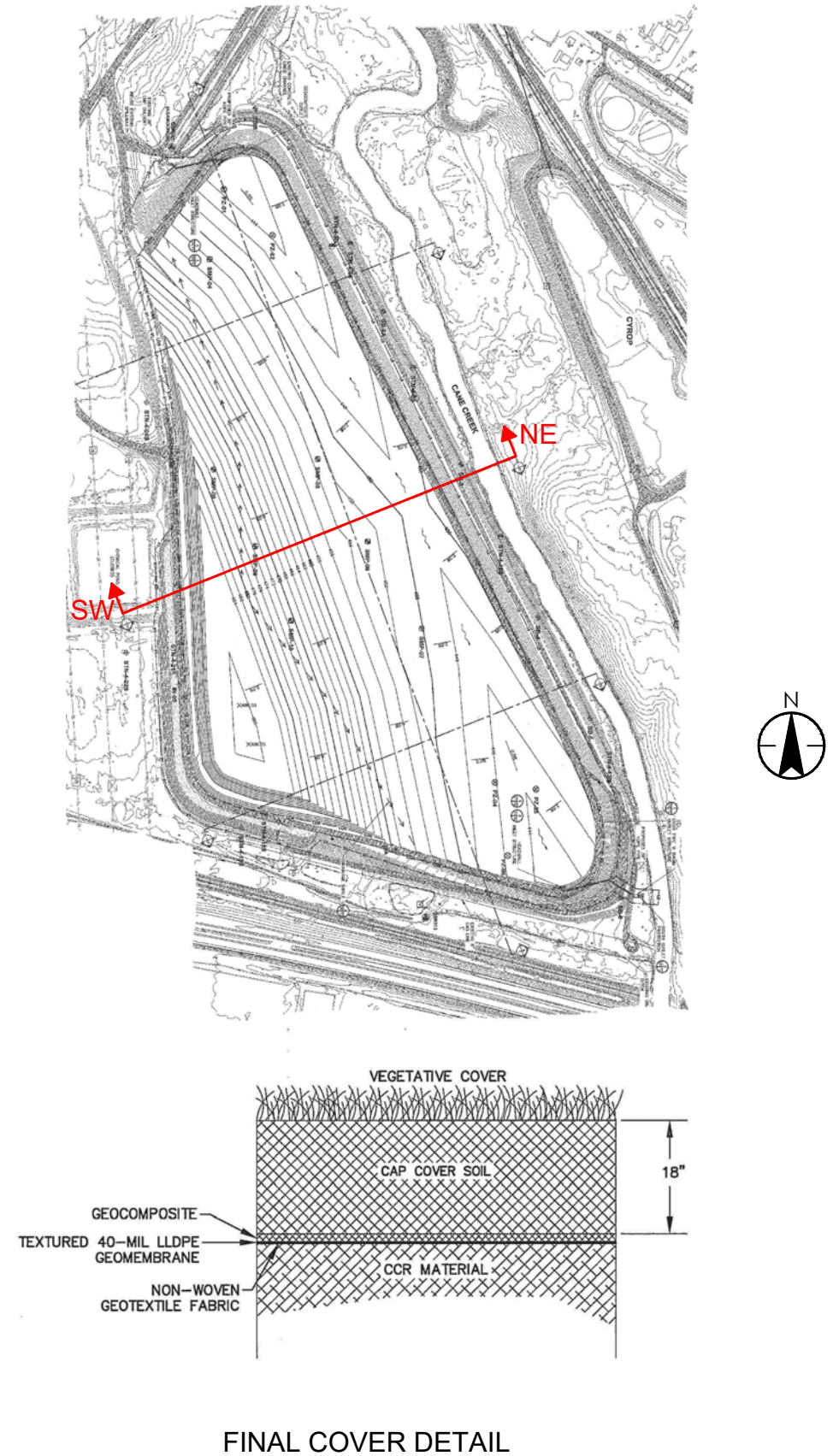
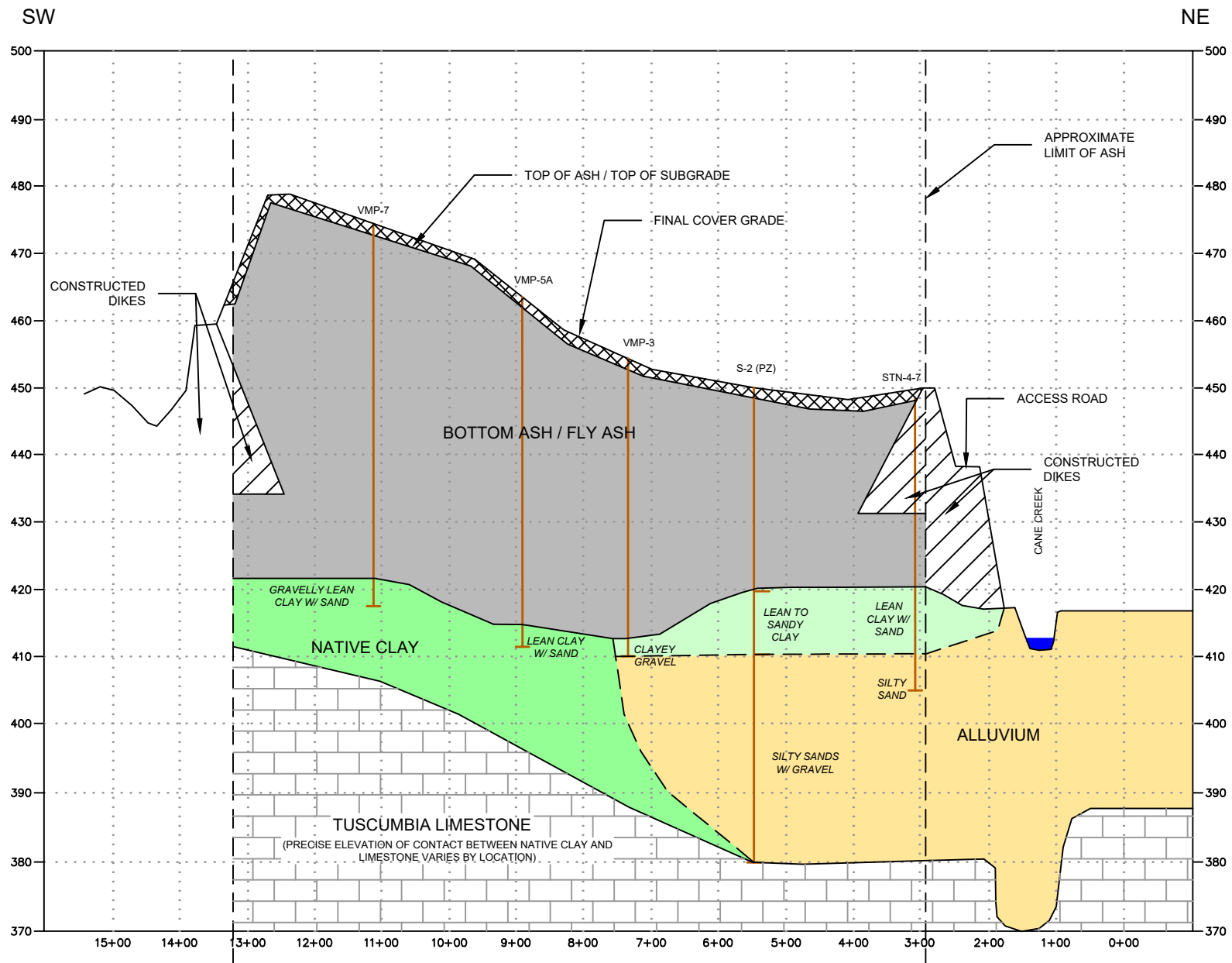
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COF FACILITY MAP

Figure No.
1

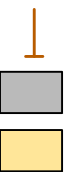
FIGURE 2
CLOSE/CAPPED ASH DISPOSAL AREA
4 CROSS-SECTION SCHEMATIC

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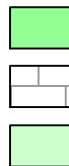
LEGEND



SOIL BORING / PIEZOMETER

ASH

ALLUVIUM / ALLUVIAL AQUIFER



RESIDUUM

TUSCUMBIA LIMESTONE BEDROCK AQUIFER

LOW PERMEABILITY SOILS

NOTE:

BASED ON GEOTECHNICAL BORINGS, THE BASE ELEVATION OF ASH IN ASH POND 4 RANGE BETWEEN 413.5 TO 425.8 FT NAVD 29.

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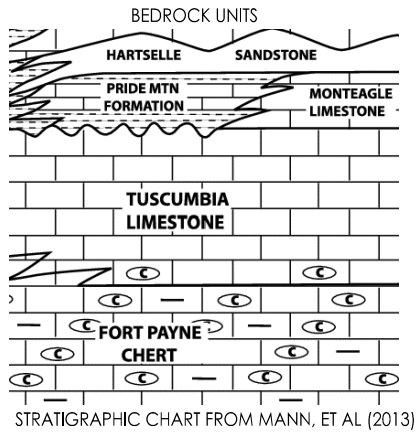
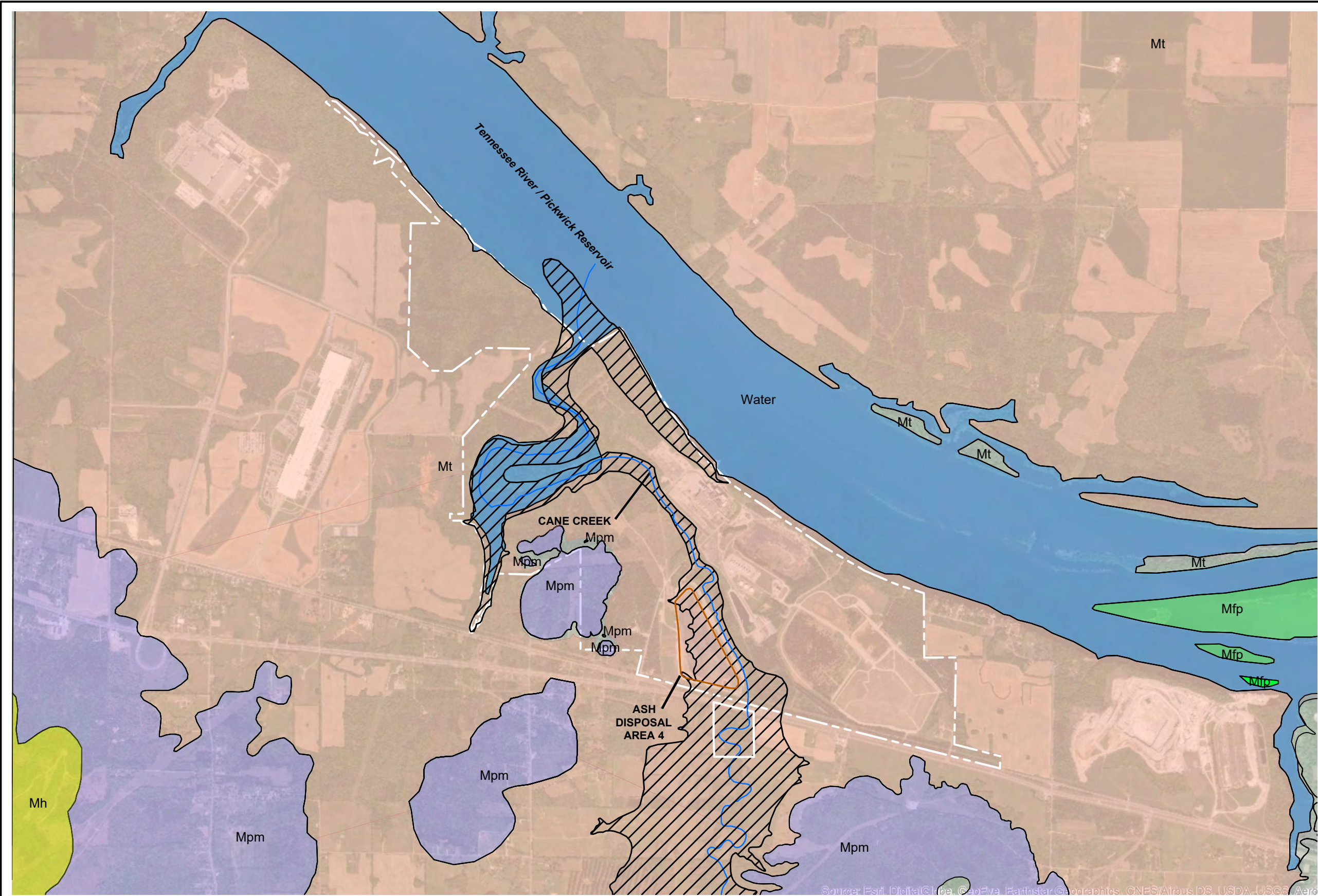
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Title
CLOSED / CAPPED ASH DISPOSAL
AREA 4 CROSS-SECTION
SCHEMATIC

Figure No.
2

FIGURE 3
SITE GEOLOGIC SETTING

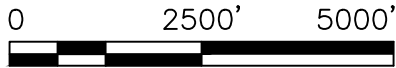
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SURFICIAL ALLUVIAL DEPOSITS

NOTE:

EXTENT OF RESIDUUM SOILS DERIVED FROM WEATHERED TUSCUMBIA LIMESTONE IS NOT DEPICTED.



LEGEND



TVA PROPERTY BOUNDARY
CCR MANAGEMENT UNIT



Mh (HARTSELLE SANDSTONE)



Mpm (PRIDE MOUNTAIN FORMATION)



Mt (TUSCUMBIA LIMESTONE)



Mfp (FORT PAYNE CHERT)

MAPPING SOURCES: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEX, GETMAPPING, AEROGRIID, IGN, IGP, SWISSTOPO, AND GIS USER COMMUNITY

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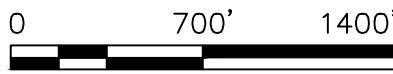
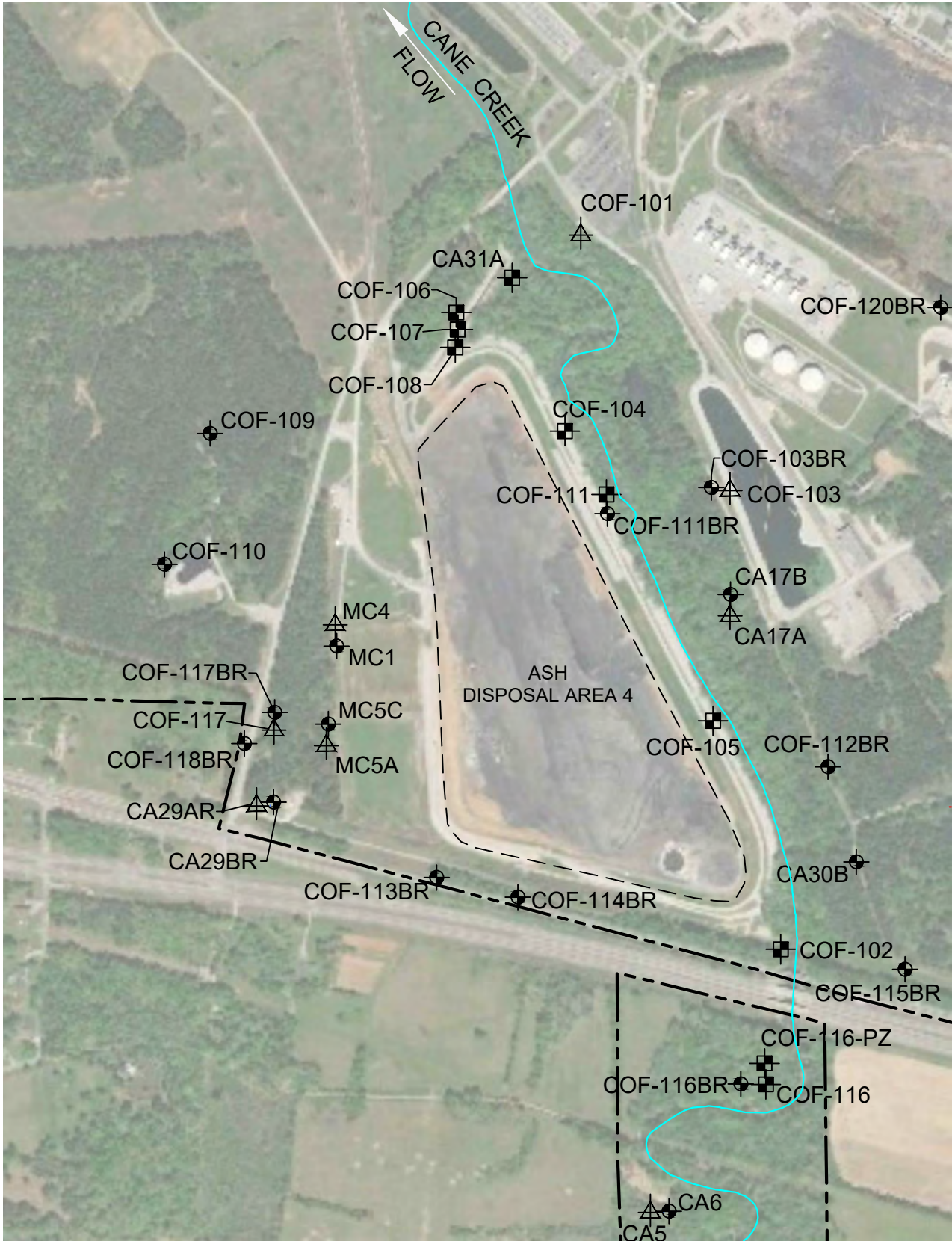
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Title
SITE GEOLOGIC SETTING

Figure No.
3

FIGURE 4
GROUNDWATER MONITORING WELL
(2020) PROXIMAL TO ASH DISPOSAL
AREA 4

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- LEGEND
-  BEDROCK MONITORING WELL LOCATION
 -  ALLUVIUM MONITORING WELL LOCATION
 -  RESIDUUM MONITORING WELL LOCATION

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182603534 300.1

Title
GROUNDWATER MONITORING
WELLS (2020) PROXIMAL TO ASH
DISPOSAL AREA 4

Figure No.
4

FIGURE 5
CCR RULE GROUNDWATER
MONITORING WELL NETWORK

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LEGEND

- ALLUVIUM MONITORING WELL LOCATION
- RESIDUUM MONITORING WELL LOCATION

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Title
CCR RULE GROUNDWATER
MONITORING WELL NETWORK

Figure No.
5